TACHA, T.C., P.A. VOHS AND G.C. IVERSON. 1985. A comparison of interval and continuous sampling methods for behavioral observations. *J. Field Ornithol.* 36: 258–264.

TRELEAVEN, R.B. 1977. Peregrine. The private life of the Peregrine Falcon. Headland Publications, Penzance, Cornwall, U.K.

Received 4 February 1992; accepted 28 October 1992

J Raptor Res. 27(1):34–36
© 1993 The Raptor Research Foundation, Inc.

ARE BALD EAGLES IMPORTANT PREDATORS OF EMPEROR GEESE?

ROBERT E. GILL, JR. AND KAREN L. KINCHELOE[1]
U.S. Fish and Wildlife Service, Alaska Fish and Wildlife Research Center, 1011 E. Tudor Road, Anchorage, AK 99503 U.S.A.

Bald Eagles (*Haliaeetus leucocephalus*) and geese often occur together, especially at sites used by geese for migrational staging and wintering. Although numerous studies have been directed at these taxa, there are only anecdotal accounts (Parris et al. 1980, Bennett and Klaas 1986, Bartley 1988) of Bald Eagles killing healthy geese at any time of the year (but see Raveling and Zezulak 1991). Most species of geese may be too large, as suggested by Sherrod et al. (1976) and Palmer (1988), or they may not regularly allow eagles an advantageous attack position (J.M. Gerrard *in litt.*).

Here we report observations of attacks on Emperor Geese (*Chen canagica*) by Bald Eagles on the Alaska Peninsula in autumn. We discuss these and other observations of eagle-goose interactions *vis-a-vis* the role of Bald Eagles as predators of Emperor Geese.

STUDY AREA AND METHODS

We recorded observations on the occurrence and behavior of Bald Eagles and Emperor Geese during a three-year study (1986–88) of Cackling Canada Geese (*Branta canadensis minima*) staging at Cinder and Hook lagoons (57°15′N 158°15′W), two large, adjacent estuaries on the northeastern Alaska Peninsula (Gill et al. in press). Observations were made daily from blinds and on foot between the last week of September and the last week of October each year. We also interviewed several long-time residents of the Alaska Peninsula and most biologists involved in on-ground studies there during the past 25 yr.

Several hundred Bald Eagles are year-round residents of the Alaska Peninsula, but probably fewer than 40 pairs nest along the north side of the peninsula (Wright in press, Dewhurst in press). Each year, however, between July and November, many eagles gather among five or six prominent estuaries along the north side of the peninsula. They are presumably attracted to these sites because of the large runs of anadromous fish and the large concentrations of staging waterfowl, primarily eiders (*Somateria mollissima* and *Polysticta stelleri*) and geese (Cackling Canada, Emperor, and Brant geese *Branta bernicla*). Indeed, between September and November each year most of the entire population of Emperor Geese (about 90 000 birds) stages on these estuaries (Petersen and Gill 1982, King and Brackney 1991). About 15 000 of these use Cinder-Hook Lagoon (R. Gill unpubl.).

OBSERVATIONS

Our first observation of an attack occurred on 12 October 1987, when we saw an adult Bald Eagle in aerial pursuit of a flock of 12 Emperor Geese. The eagle separated a juvenile goose from the flock, grabbed it by the back and neck with its talons, and then flew with it for about 400 m before landing and eating the goose.

Our second observation, on 27 October 1987, involved an attack on a goose by six eagles. One adult eagle flushed a flock of 40 Emperor Geese and attacked an adult, knocking it from the air. The eagle landed about 200 m away but did not try again to kill the goose. Over the next 20 min, five different eagles (two adult, one subadult, and two hatching-year birds) stooped individually on the goose a total of 16 times. The goose was able to evade each attack, and none of the eagles hit the goose again. About 30 minutes after the initial attack, the goose took flight from the mudflats surrounded by seven perched eagles, none of which made any attempt to attack the goose once it was in the air.

DISCUSSION

From interviews we learned of only seven other successful attacks observed when the two species occur together on the Alaska Peninsula (September–April); five of these entailed juvenile geese (G.V. Byrd, P.J. Kust, P.E. Gundersen, and J.A. Schmutz pers. comm., R. Gill pers. observation). The sole published account, from the Aleutian Islands (Sherrod et al. 1976), documented a Bald Eagle catching an adult Emperor Goose and carrying it to a sea stack.

Another point of evidence is that Bald Eagles have frequently been seen feeding on carcasses of recently killed

[1] Present address: 5421 E. 131st Ave., Anchorage, AK 99516 U.S.A.

or injured Emperor Geese (R.D. Jones, Jr. and J.A. Pratt *in litt.*, P.J. Kust, C.P. Dau, and P.E. Gundersen pers. comm., G.V. Byrd, J.A. Schmutz, J.D. Mason and R. Gill pers. observations). Although some of these birds were known to have just been shot by hunters, the others may have been injured or killed by the eagles before the observers encountered them. Residents of Nelson Lagoon, a village along the northcentral Alaska Peninsula, also have reported that in years in which the onset of winter was sudden and severe (e.g., 1970 and 1971), Bald Eagles concentrated there and frequently killed and fed on Emperor Geese. Residents have observed eagles attacking geese physically trapped in ice, geese whose flight was encumbered by freezing spray, and geese weakened to the extent that they were unable to fly. Such situations at Nelson Lagoon often entailed a few hundred geese (P.E. Gundersen *in litt.*, P.J. Kust and S. Johnson pers. comm.).

Among all species of waterfowl present during our study, Emperor Geese exhibited the most consistent and strongest flight response to the presence of Bald Eagles. They often took flight when an eagle was several kilometers away and well before most other species (e.g., Cackling Canada Geese) reacted to the eagles' presence. Since Bald Eagles do not occur on the breeding grounds of the Emperor Goose, the flight response by geese must have been reinforced through frequent and successful attacks on the goose's staging and wintering grounds.

Furthermore, observations suggest that juvenile Emperor Geese may be more susceptible to eagle predation than adults. Healthy adult Emperor Geese are relatively large ($\bar{x}$ = 2680 g ± 55 SE, range = 2230–3100 g, N = 22; C.P. Dau unpubl. data) compared with most prey taken by Bald Eagles (Sherrod et al. 1976, Gerrard and Bortolotti 1988). However, juvenile Emperor Geese are smaller ($\bar{x}$ = 2230 g ± 98 SE, range = 1900–2680 g, N = 8; C.P. Dau unpubl. data). Because juvenile geese are also less experienced and have overall greater nutritional demands than adults (Wypkema and Ankney 1979, Giroux and Bédard 1988, Raveling and Zezulak 1991), the harsh conditions throughout the winter range may weaken them and render them more vulnerable than adults to predation.

Another measure of the effect eagles have on geese is the number of disruptions to feeding flocks of geese caused by eagles. One or more Bald Eagles were present on the area on 70 of 81 d, representing 192 eagle-days of sightings. Mass disruptions of feeding geese by Bald Eagles occurred 71 times during the study, or on average about once a day. Disruptions were most prevalent ($\bar{x}$ = 2.7/day) towards the end of the staging period in mid- to late-October each year, when numbers of geese and eagles reached their peak. On a few days during this period as many as 8–10 disruptions were noted. Numerous other disruptions of geese were observed, many were too distant to identify the cause, but behavior of the flocks suggested that eagles were involved.

The evidence we have presented suggests that Bald Eagles frequently attack live Emperor Geese, particularly juveniles. That this species is rarely recorded as eagle prey (Murie 1940, Krog 1953, White et al. 1971, 1977, Sherrod et al. 1976) is probably an artifact of the relatively short periods when eagles, geese, and biologists occur together. For example, by early May, when most eagles in southwestern Alaska hatch and begin feeding their young, Emperor Geese have already migrated to the breeding grounds (Sherrod et al. 1976, Petersen and Gill 1982, Gill et al. 1981, Byrd and Williams in press).

Given the recent decline in the Emperor Goose population (Petersen and Gill 1982, U.S. Department of Interior 1989, King and Brackney 1991) and the relatively large and stable population of Bald Eagles in southwestern Alaska, any assessment of winter mortality in Emperor Geese needs to consider predation by Eagles. This information is especially needed for areas such as the eastern Aleutian Islands, where geese remain for long periods, eagles are abundant, and frequent and harsh winter storms may directly kill geese or lead to increased predation by eagles.

RESUMEN.—La presencia tanto de águilas *Haliaeetus leucocephalus* como de gansos *Chen canagica* ocurre al mismo tiempo en el sudoeste de Alaska y las Islas Aleutinas, entre septiembre y abril. Durante los estudios en la península de Alaska entre 1986 y 1988, hemos observado dos ataques de Águila Cabeciblanca contra los gansos. Presentamos tanto estas observaciones como otras que documentan la depredación causada por esta especie de águila en el ganso *C. canagica*; también se discute el rol de esta ave raptora como depredadora de ellos, especialmente cuando las víctimas están en su etapa juvenil. La reciente declinación poblacional de gansos, y la grande y estable población de *H. leucocephalus,* justifican adicionales estudios sobre esta águila como factor en la mortalidad que en invierno ocurre en los gansos.

[Traducción de Eudoxio Paredes-Ruiz]

ACKNOWLEDGMENTS

We thank C.P. Dau for sharing his unpublished data, and G.V. Byrd, P.J. Kust, P.E. Gundersen, J.A. Schmutz, R.D. Jones, Jr., J.D. Mason, S. Johnson, and C.P. Dau for sharing their unpublished observations. R.G. Anthony, G.V. Byrd, C.P. Dau, C.M. Handel, W.G. Hunt, J.A. Gerrard, R.D. Jones, Jr., M.R. Petersen, J.A. Schmutz, and R. Thurken commented on earlier drafts of the manuscript.

LITERATURE CITED

BARTLEY, J. 1988. Bald Eagle kills and carries Giant Canada Goose. *Blue Jay* 46:87.

BENNETT, R.S., JR. AND E.E. KLAAS. 1986. Bald Eagle pursues and injures Snow Goose in flight. *Raptor Res* 20:75–76.

BYRD, G.V. AND J.C. WILLIAMS. In press. Distribution and status of Bald Eagles in the Aleutian Islands, Alaska. *In* P. Schempf and M. Hermans [EDS.], Bald Eagles in Alaska. American Bald Eagle Research Institute and University of Alaska Southeast, Juneau, AK U.S.A.

DEWHURST, D.A. In press. History and status of Bald Eagle population and productivity studies on the Alaska Peninsula. *In* P. Schempf and M. Hermans [EDS.], Bald Eagles in Alaska. American Bald Eagle Research

Institute and University of Alaska Southeast, Juneau, AK U.S.A.

GERRARD, J.M. AND G. BORTOLOTTI. 1988. The Bald Eagle, the haunts and habits of a wilderness monarch. Smithsonian Institution Press, Washington, DC U.S.A.

GILL, R.E., JR., M.R. PETERSEN AND P.D. JORGENSEN. 1981. Birds of the northcentral Alaska Peninsula, 1976–1980. *Arctic* 34:286–306.

———, C.A. BABCOCK, W.I. BUTLER, JR., D.G. RAVELING AND C. M. HANDEL. In press. Site fidelity and use of fall staging grounds in Alaska by Cackling Canada Geese. *In* D. Rusch, D. Humberg, and M. Samuel [EDS.], The Canada Goose. The Wildlife Society and International Canada Goose Symposium, Milwaukee, WI U.S.A.

GIROUX, J-F. AND J. BÉDARD. 1988. Age differences in the fall diet of Greater Snow Geese in Quebec. *Condor* 90:731–734.

KING, R.J. AND A.W. BRACKNEY. 1991. Fall population survey of Emperor Geese (*Chen canagica*) on coastal southwest Alaska. Unpublished report. Fish and Wildlife Service. U.S. Department of the Interior, Anchorage, AK.

KROG, J. 1953. Notes on the birds of Amchitka Island, Alaska. *Condor* 55:299–304.

MURIE, O.J. 1940. Food habits of the northern Bald Eagle in the Aleutian Islands, Alaska. *Condor* 42:198–202.

PALMER, R.S. 1988. Handbook of North American birds. Vol 4. Diurnal raptors (Part 1). Yale University Press, New London, CT U.S.A.

PARRIS, S.D., E.E. KLAAS AND R.A. WILSON. 1980. Coyote steals Snow Goose from Bald Eagles. *Raptor Research* 14:88–89.

PETERSEN, M.R. AND R.E. GILL, JR. 1982. Population and status of Emperor Geese along the north side of the Alaska Peninsula. *Wildfowl* 33:31–38.

RAVELING, D.G. AND D.S. ZEZULAK. 1991. Autumn diet of Cackling Canada Geese in relation to age and nutrient demand. *Calif. Fish Game* 77:1–9.

SHERROD, S.K., C.M. WHITE AND F.S.L. WILLIAMSON. 1976. Biology of the Bald Eagle on Amchitka Island, Alaska. *Living Bird* 15:143–182.

U.S. DEPARTMENT OF INTERIOR. 1989. Comprehensive management plans for arctic nesting geese in Alaska. Unpublished report U.S. Department of the Interior, Fish and Wildlife Service, Anchorage, AK U.S.A.

WHITE, C.M., W.B. EMISON AND F.S.L. WILLIAMSON 1971. Dynamics of raptor populations on Amchitka Island, Alaska. *BioScience* 21:623–627.

———, F.S.L. WILLIAMSON AND W.B. EMISON. 1977 Avifaunal investigations. Pages 227–260 *in* M.L. Merritt and R.G. Fuller [EDS.], The environment of Amchitka Island, Alaska. National Technical Information Service, Springfield, VA U.S.A.

WRIGHT, J. In press. Distribution and status of Bald Eagles in western Alaska. *In* P. Schempf and M. Hermans [EDS.], Bald Eagles in Alaska. American Bald Eagle Research Institute and University of Alaska Southeast, Juneau, AK U.S.A.

WYPKEMA, R.C. AND C.D. ANKNEY. 1979. Nutrient reserve dynamics of Lesser Snow Geese staging at James Bay, Ontario. *Can. J. Zool.* 57:213–219.

Received 31 March 1992; accepted 28 October 1992